A Guide To Help Facilities Perform A Pollution Prevention Analysis
(Per Section 6 of the Pollution Prevention Plan)
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How do I begin?

Easy steps to get started

- Download the guidance manual.
- Develop a formal policy on pollution prevention.
- Gather a team of employees to work on developing the plan.
- Look at your chemical losses and determine the reasons why each waste was generated, why emissions occured and why toxic substances were used.
- Develop a detailed understanding of these reasons and discuss alternatives to them.
- Develop pollution prevention opportunities and goals.
- Complete the Pollution Prevention Plan forms and mail to ADEQ.
- Implement pollution prevention goals.

A thorough pollution prevention analysis requires a commitment and involvement by management and employees. Establishing and implementing a successful pollution prevention program requires a proper work plan and a systematic approach. **ADEQ expects facility management and employees to make and fulfill a serious commitment to reducing toxic substance use and hazardous waste generation.**

The first priority is to establish a formal written policy on pollution prevention, and to promote your company's philosophy, practices and goals. Ideally, it should encourage employee participation and establish quantitative goals. The written policy should be distributed or posted to create awareness of pollution prevention. This is an important step, regardless of the size of the facility.

Second, assign resources. Management must support the policy established in the first step and be willing to commit the resources to support the pollution prevention program. A clear statement of this commitment is vital.

The starting point for gathering background data is to identify the toxic substances, inputs and hazardous waste sources. Identify the various process steps conducted at your facility, and describe the current process including the material inputs, outputs, and products or services produced. Information on hazardous waste manifested off-site, hazardous wastewater effluent and chemical use in your facility are necessary for a good source reduction review. The information may come from a variety of sources:

- Hazardous waste manifests
- Annual hazardous waste generator reports
- Wastewater flow records
- EPCRA section 313 reports
- Environmental audit reports
- Permits
- Lab reports or characterization data

- Chemical inventory, purchasing and usage records
- Internal waste tracking system records
- Production records
- Material safety data sheets

These sources of information are helpful in calculating the total toxic substance used and wastes generated. They also provide valuable information such as hazardous characteristics and current management techniques.

The analysis can include an assessment phase, a feasibility phase, and an implementation phase.

- **Assessment phase:**
  - Select a leader and people for cross-functional assessment team
  - Identify and document all chemicals used, wastes and emissions generated
  - Prioritize and select assessment targets
  - Review data and inspect site
  - Document information using process maps, root cause (fishbone) diagrams, etc.
- **Feasibility phase:**
  - Generate pollution prevention opportunities
  - Screen and select opportunities for further study
  - Technical evaluation
  - Environmental evaluation
  - Economic evaluation
  - Select opportunities for implementation
  - Justify projects and obtain funding
  - Establish goals and schedules
- **Implementation:**
  - Installation (equipment)
  - Implementation (procedure)
  - Evaluate performance

Starting your analysis

Each pollution prevention plan must contain a pollution prevention analysis. Perhaps the most important part of the overall plan, this analysis will help you to identify pollution prevention opportunities that will result in a reduction or elimination of toxic substance usages or releases, or hazardous waste generation.

In general, this analysis should be a thorough, systematic assessment or evaluation of the processes, operations, wastestreams and toxic substance usage that utilize toxic substances or generate hazardous waste. During this analysis, you will identify areas where the potential exists for implementing pollution prevention measures, then further evaluate these measures to determine overall feasibility.

Instructions provided in this section for completing an analysis are intended as general guidelines, rather than prescriptive requirements as to what must and must not be included. The Department of Environmental Quality recognizes that the facility owner, operator, and individual employees possess intimate knowledge of facility

operations, knowledge of equipment, material inputs, and operating practices and processes. It is this knowledge that is crucial to completing the required analysis.

The instructions for completing a pollution prevention analysis have been broken down into several discrete steps.

1. In the first step, you should conduct a preliminary assessment to identify the processes, practices, or operations that utilize toxic substances and/or generate hazardous wastes or toxic releases at your facility.
2. After this preliminary assessment, the wastestreams or toxic substance usages that you have identified are prioritized, and a more detailed assessment is then completed for those areas ranked the highest.
3. After the detailed assessment, then you will identify pollution prevention opportunities based on the information provided from the detailed assessment. You will screen the opportunities you have identified down to those measures that you feel have merit and warrant further evaluation.

As you perform this analysis, however, keep in mind that you are allowed considerable flexibility. When going through this process, for example, you may find that the order of the steps presented should be altered, or that two or more steps can be conducted simultaneously. The end product, however, should be a thorough review of your facility operations and the identification of viable pollution prevention opportunities that will be implemented.

Organizing your progam

Management commitment
A key element of implementing pollution prevention is management support. Department, Facility and/or corporate management needs to commit the necessary resources to support pollution prevention activities. Management can communicate this support through approval of facility or corporate pollution prevention mission/vision/policy statements.

Team champion
Management also communicates this support by naming a champion, facilitator or focal point to lead the program. This person can lead a cross functional team to implement the program. Although it is nota direct requirement for completing a pollution prevention plan, it is strongly recommended that each facility establish a cross functional team that will have the responsibility as the overall force to lead the program, facilitate completing the analysis, incorporating the results into the pollution plan, and directing the plan goals implementation.

The size of this team will depend on the size and complexity of your organization, and it may be comprised of one or more individuals. In general, this team should be multi-disciplinary, composed of individuals with substantial technical, business, and communication skills, and possibly include management, legal, financing/accounting/purchasing, research and development, environmental and process engineers, production supervisors/personnel, experienced line-workers, quality assurance, and maintenance staff.

Document when you establish your team. One individual, from the highest level practical, should be named team leader. This individual should have the authority

and influence as the overall champion to ensure that the pollution prevention analysis is completed and incorporated into a pollution prevention plan.

Preliminary assessment

A preliminary assessment is an overall evaluation of your facility's operations to understand the relationships between these operations, the toxic substances used, and the wastes generated. In general, there are two approaches to completing this evaluation. One approach focuses on the inputs or toxic substance use, while the other approach focuses on the output or wastestream. Either approach can be used to identify pollution prevention alternatives, but there are some shortcomings associated with each.

Therefore, for the purposes of this analysis, a combination of the two approaches should be used, one that considers both inputs and outputs so that the overall flow of materials or throughput can be evaluated. This approach is most appropriate because pollution prevention concerns all media - air, water, and land, and an approach that focuses only on inputs or outputs may not account for all toxic releases or waste generation in each of these media.

During the preliminary assessment, the team should collect background information on the facility's operations, toxics usage, and wastestreams in order to prioritize and select areas for more detailed evaluations. However, before beginning this assessment, you should determine if there is an already existing pollution prevention program in place at your facility. Even if there is no formal program, there may have been some prior pollution prevention planning conducted in response to requirements of other state or federal laws. There may be some existing corporate pollution prevention directives or goals that need to be obtained. You can begin your pollution prevention analysis using information from these existing pollution prevention plans or efforts.

The preliminary assessment should consist of the following steps:

- Identify the major products produced (e.g., printed circuit board, paint) or services provided (e.g. automobile engine repair, drycleaning) by your facility.
- Identify the amount of product produced (e.g., square feet of printed circuit board, gallons of paint) or service provided (e.g., number of car engines repaired, number of articles of clothing drycleaned) for each process or operation.

This information can usually be obtained from:

- Production records
- Sales receipts
- Cost accounting reports

For each product or service, delineate the current operations, processes, and practices used, and, if possible, break these operations, processes, and practices down into individual steps. For each discrete step, compile this information on a worksheet.

This information can usually be obtained from:

- Process flow diagrams
- Operating manuals and process descriptions
- Facility or equipment layout drawings
- Operating procedures

Identify the toxic substances (e.g., sulfuric acid, methyl ethyl ketone, lead) used as inputs for each process, operation, or practice. For each substance, describe the quantities used, the primary function of this material (feedstock, catalyst, intermediary) and final destination (consumed in product, process waste, reused).

Compile this information on a worksheet. This information can usually be obtained from:

- Form R (EPCRA section 313)
- Inventory and purchasing records
- Operating manuals and process descriptions
- Production records
- Operator data logs
- Material safety data sheets

Identify the wastestreams (e.g., spent cleaning solvent, sludge, chemical baths) generated from each process operation, or practice (including maintenance). For each wastestream, describe the quantities generated, the physical or chemical composition, and the associated handling/treatment/disposal activities.

Compile this information on a worksheet. This information can usually be obtained from:

- Hazardous waste manifests
- Facility annual hazardous waste report
- Wastewater flow records
- Permits (NPDES, RCRA Part B, etc.)
- Lab reports/characterization data
- Internal waste tracking system records
- Environmental audit reports

Putting it all together

Once all the background information has been collected on your facility's operations, toxic substance usage and waste generation, it is necessary to put it together in a form that will clearly illustrate the overall use and loss materials as well as relate that material losses to the production process.

Using the information collected during the preliminary assessment, develop a process map for each process step. The process schematically depicts a facility process, using boxes to show the series of steps through which materials and other inputs pass. Process maps are a visual means of organizing material accounting, and to pinpoint how a loss is occcurring and where it is going.

Once completed, the team should review the process maps to identify any data gaps and conflicts, or areas where more information is needed. Obtain the missing information if readily available, or make estimates as necessary, and incorporate into the process map. A process's use and loss of energy and water can also be recordede on the process map.

Based on the completed process maps, the team should then develop a *cause and effect* or *fishbone* diagram. After completing the fishbone diagram, prioritize the wastestreams, toxic substances used, operations, or processes for a detailed assessment to identify pollution prevention opportunities. Ideally, all wastestreams, toxics usage, operations, or processes should be evaluated in detail to identify pollution prevention opportunities. However, this is usually not practical for many facilities, especially those with limited resources. Therefore, rank all areas (wastestreams, toxic usage, processes, and operations) and select those areas targeted for further assessment based on the following criteria:

- Quantity of waste generated
- Type and hazardous nature of the waste
- Treatment and/or disposal costs
- Occupational health and safety considerations
- Potential for (or ease of) implementation
- Quantity of toxic substance used
- Regulatory compliance (current and expected future)
- Position on pollution prevention hierarchy
- Reducing energy usage
- Available budget/payback time
- Opportunity for economic savings
- Opportunity to perform process improvement/optimization
- Opportunity for quality improvement

Detailed assessment with a site visit

After selection of targeted areas (processes, operations, wastestreams, or toxics usage) for further evaluation, the team should become as familiar with each area as possible. This can be achieved by performing a thorough site review and interviewing employees. Use this site review to verify the actual operation or processes, to answer any questions that may have arisen during the preliminary assessment, and to obtain more detailed information if required. A questionnaire is useful for obtaining more detailed information. In addition, you should interview employees who operate processes and equipment, as they are most knowledgeable of the actual operations, and their experience and opinions concerning pollution prevention opportunities can be quite valuable.

Incorporate any new information or data into the process maps for each of the targeted areas. Based on the information obtained from the preliminary and detailed assessment, develop a description for each area that will be the focus of your pollution prevention efforts.

Overall, the detailed assessment is intended to provide more comprehensive information and data on the targeted areas. This information is crucial to identifying pollution prevention opportunities, as it serves to highlight where the potential for source reduction or recycling activities exists, and a general indication of the feasibility of the various pollution prevention measures.

Identify pollution prevention opportunities

After the detailed assessment has been completed, it is necessary to evaluate the targeted areas in terms of the source reduction or recycling opportunity available. This is the creative phase of the pollution prevention analysis during which the team proposes and then screens pollution prevention opportunities for each area. Brainstorming sessions are very useful during this phase, allowing for the proposal of a wide variety of pollution prevention opportunities. As a minimum, however, the team should consider the following opportunities for each targeted area:

- Input changes or material substitutions
- Operational improvements or improved housekeeping
- Production process changes/process optimization
- Product redesign or reformulation
- Closed loop recycling systems
- Direct reuse or reclamation systems
- Best management practices

At the present, there are numerous sources of information available to help you identify pollution prevention opportunities, both general and industry specific. The very first source, however, should be individuals from within your organization, including line-employees, operators, supervisors, engineers, plant managers, purchasing agents, and others with first-hand knowledge of the facility's operation. In addition, potential outside sources of information include:

- State/local environmental agencies' publications and technical assistance programs
- Arizona Department of Environmental Quality's clearinghouse of pollution prevention information and library (602) 771-2217
- EPA publications, databases, and technical reference centers
- Published literature, technical and trade journals, and government reports
- Equipment vendors and chemical suppliers
- Trade associations
- Competitors

The initial set of proposed pollution prevention opportunities must now be screened to identify those opportunities that have a real potential for pollution prevention. Screen this initial set of opportunities to eliminate those perceived to be marginal, impractical, or inferior prior to conducting more detailed and time consuming feasibility studies. This preliminary screening may consist of an informal decision made by the team leader, or the use of a weighted sum method of screening. Questions to consider during the screening include:

- What opportunities will best achieve the goal of pollution prevention?
- What are the main benefits to be gained by implementing this measure?
- Does the necessary technology exist to develop this measure?
- Can the measure be implemented within a reasonable amount of time?
- What other areas will be affected?
- Does this measure have a good or proven "track record?" Is there strong evidence that it will work as required?
- Is this opportunity compatible with the existing facility operation?
- How much downtime, training, etc. will be required to implement this measure?

- How much does it cost?
- Does it appear to be cost-effective?

This preliminary screening should result in an intermediate set of pollution prevention opportunities, i.e, "intermediate opportunities." Use a worksheet to assist you with this screening process. The "intermediateopportunities" are those that are perceived to have some merit and warrant further analysis to determine if they are viable "options" that can be implemented.

Feasibility studies
The pollution prevention "intermediate opportunities" resulting from the brainstorming and preliminary screening phase of this analysis will be further evaluated to determine if they are in fact feasible "options." In general, you should complete some level of economic, environmental, and technical feasibility study for each intermediate opportunity.

Consider the following factors when completing an **economic** feasibility study:

- Reduced hazardous waste costs (disposal, management, etc.)
- Raw material cost savings
- Insurance and liability savings
- Increased costs (or savings) associated with product quality
- Decreased (or increased) utilities costs
- Decreased (or increased) operating and maintenance
- Costs due to cycle time changes
- Decreased (or increased) overhead costs
- Capital costs
- Manpower costs

Consider the following factors when completing a **technical** feasibility study:

- Will it work in this application?
- How has it worked in similar applications?
- Is space available? Are utilities available or must new utilities be installed?
- Is the new equipment or procedure compatible with the facility's operating procedures, work flow, and production rates?
- What is the downtime associated with installation or implementation of the opportunity?
- Will the product quality be maintained or improved?
- Is special expertise required to operate or maintain the new system? Does the vendor provide acceptable service?
- Are any new safety hazards created?

Consider the following factors when completing an **environmental** feasibility study:

- What is the effect of this opportunity on the number and toxicity of wastestreams?
- What is the risk of transfer of pollutants to other media?
- What is the environmental impact of alternative input materials?
- What is the associated energy consumption?
- Are any new environmental hazards created?

Based on completed feasibility studies, a decision is made whether the pollution prevention intermediate opportunities can and will be implemented as pollution prevention opportunities. These are pollution prevention opportunities that are in fact feasible and could be implemented at your facility. Please note that although an opportunity may be feasible, it does not necessarily mean that it must be implemented. For example, there may be more than one pollution prevention opportunity available for a particular wastestream. It may not be possible for a facility to implement all feasible opportunities at once.